

1. A supported mesoporous carbon membrane comprising:
  - (a) a support having at least one through-pore; and
  - (b) a mesoporous carbon material attached to the support and filling at least a portion of the at least one through-pore.

5        2. The supported mesoporous carbon membrane of claim 1, wherein the support is stainless steel.

      3. The supported mesoporous carbon membrane of claim 1, wherein the support has a through-pore size of from about 0.1 to 100  $\mu\text{m}$ .

10       4. The supported mesoporous carbon membrane of claim 1, wherein the support has a through-pore size of about 0.2  $\mu\text{m}$ .

      5. The supported mesoporous carbon membrane of claim 1, wherein the membrane has a through-pore size distribution of from about 1 nm to 100 nm.

      6. The supported mesoporous carbon membrane of claim 1, wherein the membrane has an effective through-pore size of between about 1 nm and 10 nm.

15       7. The supported mesoporous carbon membrane of claim 1, wherein the membrane has a maximum operating pressure of 1000 psig.

      8. The supported mesoporous carbon membrane of claim 1, wherein the membrane has a maximum operating temperature greater than 200°C.

20       9. The supported mesoporous carbon membrane of claim 1, wherein the membrane has a water permeance of from  $4.4 \times 10^{-08}$  to  $2.4 \times 10^{-05}$  g/s/m<sup>2</sup>/Pa.

      10. The supported mesoporous carbon membrane of claim 1, wherein the membrane has a BSA retention greater than 75 percent.

      11. The supported mesoporous carbon membrane of claim 1, wherein the membrane

has a BSA retention greater than 85 percent.

12. The supported mesoporous carbon membrane of claim 1, wherein the membrane has a BSA retention greater than 95 percent.

13. The supported mesoporous carbon membrane of claim 1, wherein the membrane has a BSA retention greater than 98 percent.

14. The supported mesoporous carbon membrane of claim 1, wherein the membrane is in the shape of a tube.

15. The supported mesoporous carbon membrane of claim 1, wherein the membrane is in the shape of a flat disc.

16. A supported mesoporous carbon membrane comprising a mesoporous carbon material and a support, the mesoporous carbon material having at least one pore in the mesoporous range of 1 to 100 nm, and the support having at least one through-pore in the macroporous range of 0.1 to 100  $\mu\text{m}$ , wherein the at least one through-pore of the support has a pore wall, and said mesoporous carbon material is in contact with at least a portion of the pore wall.

17. The supported mesoporous carbon membrane of claim 16, wherein the support has a plurality of through-pores in the macroporous range of 0.1 to 100  $\mu\text{m}$ , and wherein a portion of the mesoporous carbon material is located within all of the through-pores in the support that are in the macroporous range.

18. The supported mesoporous carbon membrane of claim 16, wherein the mesoporous carbon material is prepared by a process comprising the steps of:

- (a) applying a polymeric precursor mixture comprising a carbonizing polymer precursor and a noncarbonizing template polymer precursor to the pore wall of the at

least one through-pore of the support to form a coating on said pore wall that at least partially fills said at least one through-pore of the support; and

(b) pyrolyzing said coating to form the mesoporous carbon material.

19. The supported mesoporous carbon membrane of claim 18, wherein the  
5 carbonizing polymer precursor is poly(furfuryl alcohol) and the noncarbonizing template polymer precursor is poly(ethylene glycol).

20. The supported mesoporous carbon membrane of claim 18, wherein the weight ratio of carbonizing polymer precursor to noncarbonizing template polymer precursor in the polymeric precursor mixture is from about 1:3 to 3:1.

10 21. The supported mesoporous carbon membrane of claim 16, wherein the membrane is rigid.

22. The supported mesoporous carbon membrane of claim 16, wherein the membrane has a bimodal pore size distribution with two pore size modes, wherein one pore size mode is a mesoporous size mode in the mesoporous range of from 1 to 100 nm.

15 23. The supported mesoporous carbon membrane of claim 22, wherein the other pore size mode is a nanoporous size mode in the nanoporous range of less than 1 nm.

24. The supported mesoporous carbon membrane of claim 22, wherein said pores in the mesoporous pore size mode are in the range of from 1 to 50 nm.

20 25. The supported mesoporous carbon membrane of claim 22, wherein said pores in the mesoporous pore size mode are in the range of 1 to 10 nm.

26. The supported mesoporous carbon membrane of claim 16, wherein at least one pore of the support is completely filled with the mesoporous carbon material.

27. A process for preparing a supported mesoporous carbon membrane comprising

the steps:

(a) applying a polymeric precursor mixture containing a noncarbonizing template polymer and a carbonizing polymer to a portion of a porous support to form a coating of said polymeric precursor mixture on said portion of said porous support, and

5 (b) pyrolyzing the coating in an inert gas atmosphere.

28. A process for separating a substance in a liquid comprising filtering said liquid through the supported mesoporous carbon membrane of claim 1.

29. The process of claim 28, wherein the supported mesoporous carbon membrane is in the form of one or more tubes.

10 30. A supported porous carbon membrane comprising a porous carbon layer and a porous support, wherein the porous carbon layer is created by depositing a polymeric mixture comprising a carbonizing polymer precursor and a noncarbonizing template polymer precursor on said porous support and then pyrolyzing said polymeric mixture, and wherein the pore size of the porous carbon layer is controlled by varying the molecular weight of the template polymer precursor.

15 31. A supported porous carbon membrane comprising a porous carbon layer and a porous support, wherein the porous carbon layer is created by depositing a polymeric mixture comprising a carbonizing polymer precursor and a noncarbonizing template polymer precursor on said porous support and then pyrolyzing said polymeric mixture, and wherein the pore size of the porous carbon layer is controlled by varying the amount of the template polymer precursor present in the polymeric mixture.

20 32. A supported mesoporous carbon membrane for separating at least one macromolecular substance from a liquid, said membrane comprising:

- (a) a support having at least one through-pore which connects a first surface of said support to a second surface of said support; and
- (b) a mesoporous carbon material attached to at least a portion of at least one of said first surface and said second surface of said support;

5 wherein said mesoporous carbon material is also disposed within said at least one through-pore of said support so as to at least partially fill said at least one through-pore of said support.

33. The supported mesoporous carbon membrane of claim 32, wherein the membrane has a pore size distribution in the range of 1 to 100 nm.

34. A supported mesoporous carbon membrane comprising:

- (a) a support, said support having a plurality of through-pores in the macroporous region of 0.1 to 100  $\mu\text{m}$ ; and
- (b) a mesoporous carbon material, said mesoporous carbon material having a plurality of pores in the mesoporous region of 1 to 100 nm;

wherein said mesoporous carbon material is located within the plurality of pores in said support.

35. The supported mesoporous carbon membrane of claim 34, wherein the membrane has an effective pore size in the range from 1 to 100 nm.

36. The supported mesoporous carbon membrane of claim 34, wherein the membrane has an effective pore size in the range from 1 to 50 nm.

37. The supported mesoporous carbon membrane of claim 34, wherein the membrane  
20 has an effective pore size in the range from 10 to 30 nm.